{PRESCRIBED FORMAT FOR SUBMISSION OF PROPOSAL FOR TOPIC APPROVAL IN THE FACULTY OF SCIENCE AND TECHNOLOGY}

PROPOSAL FOR TOPIC APPROVAL TO BE SUBMITTED TO THE UNIVERSITY OF MUMBAI FOR THE PH.D DEGREE IN THE SUBJECT OF CHEMISTRY

Title of the topic	:	Removal of the heavy metal ions from the aqueous effluents by using Tannin based novel adsorbents
Name of the student	:	Miss. Rupali Shantaram Nagarekar
Basic Qualification	:	M.Sc,M.Phil,SET
Year of passing	:	M.Phil 2009, SET 2015
Name of the Research Guide	:	Dr. Kamini J. Donde
Date of Retirement of Research Guide	:	31/03/2037
Name of Research Centre	:	Ramnarain Ruia Autonomous College
Signature of the Student	:	RSNagarekar
Signature of Research Guide	:	

DATE: 03/12/21

Seal of College/Department

Signature of Head/Director/Principal Research Centre

Ramnarain Ruia Autonomous College
Matunga, Mumbai - 400 019.

Sr.No.	Contents	Page No.
1	Title	1
2	Aims of study	2
3	Objectives of study	2
4	Study Background and significance of study	2,3
5	National Status	3
6	International Status	3
7	Study Hypotheses	4
8	Study Rationale	4,5
9	Research Methodology	5
10	Statistical Plan	6
11	Limitations of the study	6
12	Expected Outcomes of Study	7
13	Select Bibliography	8

TITLE

Removal of the heavy metal ions from the aqueous effluents by using Tannin based novel adsorbents

AIM:In this proposed work, we propose to synthesize new-metal adsorbent, which may or may not have selective complexation, high adsorbing ability and low flow resistivity. The combination of tannins and cellulose are the promising systems for creating novel polymeric chelates for the waste water treatment.

OBJECTIVES:

(i) Synthesise of Tannin/cellulose/gallic acid/curcumin/-formaldehyde resins of varying tannin cellulose/gallic acid/curcumin: formaldehyde ratios in alkaline conditions (ammonia/triethyl amine) so as to establish compositions which give rise to solid resins.

(ii) Inverse suspension condensation of select compositions (which are solids) in presence of porogens/structure inducing entities to generate porous structured spherical beads.

(iii) Synthesis of crown ethers such as amino di-*tert*-butyl cyclohexano 18C6 and dibenzo18C6. (iv) Synthesis of amino functionalised calix[4]arenes.

(v) Immobilization of crown ethers and calix[4]arenes in meso- and macroporous resins.

(vi) Adsorption and desorption profiling of heavy metal ions by an interplay of pH, ionic strength and/or solvent.

STUDY BACKGROUND AND SIGNIFICANCE OF RESEARCH WORK:

In recent years, water pollution by heavy metals ion such as chromium, lead, cadmium mercury etc. has posed one of the most severe environmental problems [1-2] The industrialization and motorization of the world have led to rise in adulteration and harmful pollutants like heavy metal ions, dyes where release toxic engineering wastewater is an imperious issue for the environment. [3].

Serious environmental hazards originating from certain industrial effluents containing traces of extremely dangerous ionic species substantiate the search for other, efficient and specific separation techniques [4].There are many technologies for treatment of aqueous waste; solvent extraction and ion exchange are two of them.

Tannins are eco-friendly,bio-sourced,natural,and highly reactive polyphenols. Recently, tannins have been increasingly investigated for their interaction with other species in order to obtain tannin-based hybrid systems that feature advanced and novel properties. Such hybrid-like systems allow the preparation of various advanced nanomaterials, featuring improved performances compared to the current ones. Because of this, these diverse-shaped material have potential use in wastewater treatment or catalysis as well as in some novel fields Such as UV-shielding, functional food packaging and biomedicine[5].

NATIONAL STATUS:

A search of chemical abstracts reveals that among other, Gandhigram Rural Institute has investigated the soluble tannin resins as varnishes [6]. Tripathy et al. at Ravenshaw College have evaluated the adhesive strength of these resins [7]. Sarkar et al. at University Science College, Calcutta have evaluated tannin-phenol-formaldehyde resins as solid state catalyst for acid catalysis [8].

INTERNATIONAL STATUS:

Mitsubishi Nuclear Fuel Co. has filed US patents between 1992 and 2001 on a number of strategies for synthesis beaded form (1 to 2.4 mm) of tannin-formaldehyde resole resins using ammonia or sodium hydroxide as catalyst and has demonstrated their usefulness for the separation of uranium, neptunium, americium and curium through an interplay of pH. The resins could be regenerated by shifting the pH to lower values [9].

STUDY HYPOTHISIS:

The ability of tannin adsorbent to bind metal elements from waste liquid effluent is due to two reasons;

1) Tannin-formaldehyde resin have polyphenolic hydroxyl groups which bind metal elements by hydrogen ion exchange reaction .
2) The degree of freedom of molecular chain increases and functional group of molecular chain acquires a steric structure for easy coordination with metal elements [10].

On the other hand, cellulose is the most abundant natural polymer consisting of three reactive hydroxyl groups which is responsible for the adsorption properties and has been widely used in many fields due to its biocompatibility, biodegradability and desirable mechanical strength.

STUDY RAIONALE:

Tannin resins are used as heavy metal elements adsorbent because they do not generate poisonous gases and the volume of adsorbent can be greatly decreased. There are many methods from which tannin adsorbent are prepared. The plant-based polyphenolic tannins are the fourth most abundant form of terrestrial biomass extracted compound right after cellulose,hemicellulose and lignin.Furthermore,tannin present after lignin the most prevalent source of natural aromatic macromolecules[11].Therefore, the combination of tannins and cellulose are the promising systems for creating novel polymeric chelates for the waste water treatment.

In this proposed work, we propose to synthesize new-metal adsorbent, which may have selective complexation, high adsorbing ability and low flow resistivity.

Adsorption with tannin cellulose, curcumin and gallic acid based adsorbents, which are suitable for treating toxic and industrial waste effluents. These materials are low cost and preparation methods is ideal, hence such type of adsorbents are works for the adsorption of heavy metals ion[12-13].

Adsorption of heavy metal elements are adsorbed by tannin cellulose, curcumin and gallic acid adsorbent from solution containing one or more elements and their efficient recovery at high purity without creating any secondary waste.

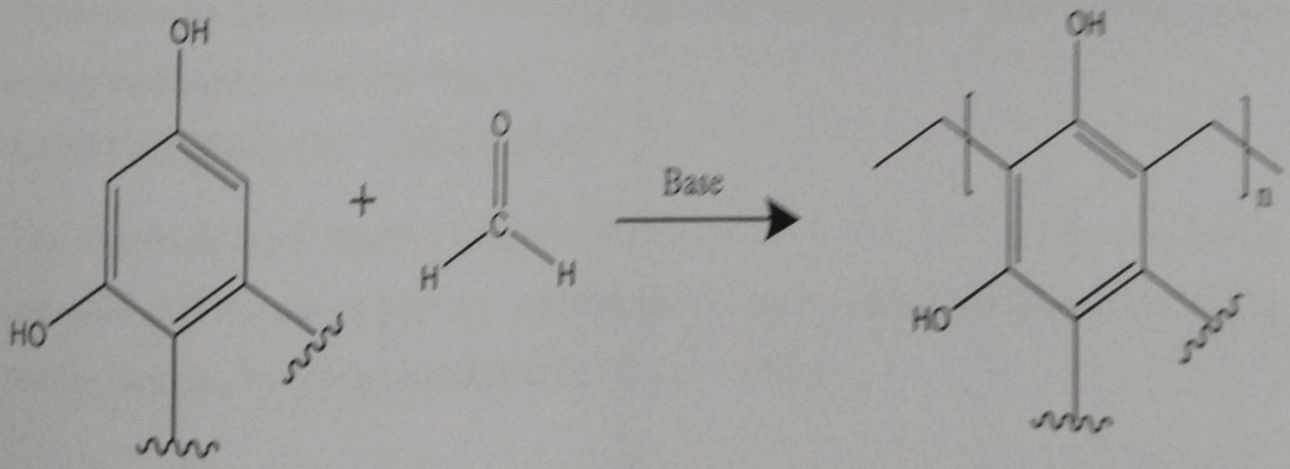
RESEARCH METHODOLOGY:

We propose new strategies for synthesis of tannin cellulose/curcumin and gallic acid-formaldehyde based polymeric beads.

1.In first step, solution and inverse suspension polymerization of tannin cellulose/ curcumin and gallic acid and formaldehyde in presence of base to give product beaded polymers.

2.In second step ,characterization of all polymers like particle size analysis, surface morphology, surface area etc. will be done.

3. Adsorption and desorption profiling of heavy metal ions by an interplay of pH, ionic strength and/or solvent.



Condensed Tannin unit formaldehyde Tannin- Polymer

STATISTICAL PLAN

First Year:

In the first phase of the study, extensive collection of references with respect to the synthesis of the desired compounds and purification of the reagents and chemicals will be done.

Second Year:

In the second phase maximum attention will be paid on the synthesis of all polymers by room temperature methodology, establishing the composition over which particles are formed, their pH related stability. The synthesized compounds will be analyzed simultaneously by IR, Scanning Electron Microscope (SEM), porosity, as well as surface area.

Third Year:

In third phase synthesized tannin cellulose/curcumin and gallic acid based adsorbents and polymer supported calixarene ligands will be bound with heavy metal elements (such as chromium, cadmium, mercury and actinides) and bound metal elements will be analyzed either by Inductive Coupled Plasma-Mass Spectroscopy (ICP-MS) or Atomic Adsorption Spectroscopy (AAS). The elements like chromium and mercury can be analyzed by UV spectrophotometer using diphenyl-carbazide reagent.

LIMITATIONS OF THE STUDY:

The results of these studies will be communicated to the peer reviewed scientific journals. All results of priority interest would be protected before releasing it to public domain by filing suitable patent applications.

EXPECTED OUTCOME OF STUDY:

Synthesis of some new tannin, cellulose, curcumin and gallic acid based metal adsorbent having analytical applications will be reported and those modified with Crown ethers and Calix[n]arene ligands will be tested for extraction of heavy metal elements.

The results of these studies will be communicated to the peer reviewed scientific journals. All results of priority interest would be protected before releasing it to public domain by filing suitable patent applications.